the spear, and one day Llew was induced by his wife to stand in the position by the cauldron he had indicated. "Thereupon Gronw rose up from the hill which is called Bryn Cyfergyr, and he rested on one knee, and flung the poisoned dart and struck him (Llew) on the side, so that the shaft started out, but the head of the dart remained in." Llew was, as we would say, mortally wounded, but nobody dies in the Mabinogion tales. They simply become transformed. Llew reappeared to return exactly the same compliment to Gronw. The latter begged of Llew to allow a stone to be placed between him and the marksman. "Then Llew flung the dart at him, and it pierced the slab and went through Gronw likewise, so that it pierced through his back."

At first sight the whole story might be regarded as a clumsy attempt at explaining the holed stone and its name. But what of the very curious details of this fabulous Order of the Bath?

The following considerations offer themselves. The typical wizard in Welsh tradition orders his body to be buried neither within nor without the church. "Standing with one foot in the grave" is a familiar expression. The picture of a man standing with one foot on the cauldron and the other on a buck's back brings to my mind another legendary picture of a man visiting a cave, where hidden treasures lie, on a cow's back. It was necessary for him to enter into the cave and return without dismounting, and he was allowed to pick up as much of the treasure as he could grab at on that bovine ride. The two Welsh words "bwch," "buck," and "buwch," "cow," are similar enough to become confused in such tales.

I would assume that the holed stone Llech Gronw was a solstitial sight-line from a circle or cromlech to the point on the horizon where the marksman stood to throw the dart. Such a sight-line was of no use except once a year, as the sun would only call once a year at that point. The spear was a year in the making. Sundays may be regarded as the moon's quarters, and though a solstitial cromlech or alignment was of use only once a year, there is evidence of a weekly ceremony of some sort at such monuments. The "curate" in charge of an astronomical monument had, like other curates, his work to do all the year round.

A holed stone between a specified hill-point and a covered structure—we have here the complete apparatus for observation from an *allée couverte*. To the archæologist, however, the holed stone is now a telescope reversed—that is, it is of use not to observe sunrise so much as to find hidden parts of the original alignment. Sir Norman Lockyer, in "Stonehenge," has shown that "holed stones were arrangements for determining alignments," and he tells us how an ancient stone alignment was traced from a circle to holed stones at Tregaseal (p. 282).

The utility of the holed stone as a path-finder, so to speak, has been proved by Dr. Baudouin, in France. At the third "Prehistoric" congress of France last year (reported in NATURE, October 24, 1907, p. 649), he showed that "menhirs were indicators of megalithic sepultures." "By using two certain holed stones as indicators, he was enabled to discover an *allée couverte* which was buried under the soil, and had until then remained undiscovered. This 'find,' made with remarkable scientific precision, was received by numerous foreign congressists as a striking example of the value of a theory which many of them still ignore."

The best oral tradition of a cave with sleeping warriors guarding treasure I have been able to collect at first hand is widely known at Devil's Bridge, Cardiganshire. All the story, which I have dove-tailed out of five versions, would occupy more space than I can reasonably expect to have here. Though it is known that the cave is situate on a woody slope on the farm of Tynycastell on the south side of the river Rheidol, no one living has seen it. But tradition has it that the mouth of the cave is sometimes seen from some point on Penrhiw farm on the north or opposite side of the valley. If my recollection is correct, that farm is north-east, and on the sky-line, from the traditional site of the cave, and if a careful search were made for some alignment or indicator at Penrhiw, possibly the hidden cave might be re-discovered. At any rate, the fact that the mouth of the cave used to be seen from Penrhiw indicates that the cave was a summer solstice *allée couverte*. This is further confirmed by the tradition that the mouth of the cave was to be seen from Penrhiw only once a year. These inferences as to the solstitial use of the cave are amply confirmed by the most definite local tradition.

This was the cave where the visitor had to enter and leave on a cow's back. Another version has it that there were three steps into the cave. When the visitor stood on the first step, a sleeping warrior inside awoke; when he stood on the second step, the warrior laid his hand on his sword; and when he stood on the third, the warrior cut off with his sword the lighted head of the candle which the visitor held in his hand. Another version simply gives it that when the visitor entered a warrior awoke and asked, "A ddaeth y tri bore'n un?" (Have the three mornings become one?) For about five years I kept troubling our folklore authorities for an explanation of that strange question, and quite in vain. Sir Norman Lockyer solved the conundrum by return of post. The three mornings in one are the three days of the solstice, when the sun stands still, and because of that apparent stationariness the three days were reckoned as one.

I believe that the well-known tradition at Devil's Bridge of a demon or hero imprisoned in a rock is a part, if not the leading part, of the cave legend of Tynycastell close by. He is popularly believed to be working his way out of a rock a "fathom" deep with "an ounce hammer and a clog nail," or, as a more degenerate tradition has it, "an ounce hammer and a carpet-tack."

So much about a living tradition of a solstitial cromlech in actual use, and a tradition which has apparently survived the cromlech itself. By the bye, the "cave" is never a tomb. Its occupants are always alive, alive not as mere ghosts. Mr. T. H. Thomas has observed that "wraiths of human guardians, or inhabitants, are rare about cromlechs, while they are remarkably numerous about tumuli." While the cromlech in most instances seems to have been converted into a tomb, it is interesting to note that its folklore associations must have become fixed before such a conversion, and agree with and elucidate the astronomical interpretation of the use of the cromlech.

JOHN GRIFFITH.

THE PRAGUE EXHIBITION.

FOR commercial purposes, the kingdom of Bohemia is divided into five districts, each under an officially recognised chamber of commerce. The district of the Prague Chamber of Commerce is the largest and most important of these. It has a population of two millions, a third of the population of the kingdom, and includes many of the chief centres of industry. The organisation of the Jubilee Exhibition at Prague is due to the enterprise of the committee of the Prague Chamber of Commerce. From every point of view the exhibition is a success. It is attracting a daily attendance of from 10,000 to 60,000 persons, who come from all parts of the world. The exhibition occupies an enclosure in a beautiful, well-wooded park on the outskirts of the city. In the effective design and picturesque arrangement of its buildings it is a model of what such an exhibition should be.

As would be expected, the character of the exhibition is definitely commercial; but pure art is not entirely neglected, and the orchestral concerts of the Bohemian Philharmonic Association are of a high order. No fewer than eighteen imposing pavilions have been specially built, and in addition use is made of a permanent building, erected originally for the exhibition of 1891. These buildings are devoted to the City of Prague, the chamber of commerce, machinery, the cities of the district, ceramic and glass industries, schools, goldsmiths' work, food, metal work, leather industries, chemical industries, graphic arts, photography, commerce, and temporary exhibits. Speaking generally, the exhibits in all departments show a high standard of design, finish, and workmanship. In view of the fact that many of the industries mentioned have only been established in Bohemia in recent years, the high quality of the manufactures is certainly remarkable.

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Not less remarkable is the increase in the amount of the manufactures. In 1891 one building was sufficient to include a representative exhibit of the manufactures of the district; now it is difficult to compress such an exhibit into nineteen buildings. Trade returns confirm the impression which this comparison suggests.

An inquiry naturally suggests itself into the causes of this development. Recent years have certainly seen a great awakening of national life in Bohemia, but this alone would not be sufficient to account for the commercial prosperity of the country. A better explanation is to be found in the system of technical education which is being successfully worked in Bohemia. The scope and character of this system is admirably displayed in a well-arranged exhibit. Undoubtedly the keynote of the system is "specialisation," a word which has no terrors for the Bohemian, who is surprised that the exhibits from some of the special schools—such, for example, as that from a school for training barbers—should cause amusement to the English visitor; but, nevertheless, the fundamental principle of the system seems to be sound. A boy's trade is fixed, and whether or not he is apprenticed, he is trained definitely for the selected trade, without too much insistence on theoretical principles. If the boy is apprenticed he is obliged to attend an industrial continuation school during his apprenticeship. In these schools there are from six to ten hours of instruction per week, the lessons being given in the afternoons or early in the evening and on Sunday mornings. The course lasts from two to four years. If the boy is not apprenticed he is able to attend one of the special schools (*Fachschulen*) in which courses are provided, definitely taking the place of the apprenticeship. The industries included in the scope of these schools are lace-making, wood-carving, carpentry, cabinet-making, textile industries, basket-making, iron and steel work, engineering, masonry, glass-making, hardware goods, electro-engineering, locksmiths, musical instruments, jewellery, precious stone setting, machine embroidery, watch-making, and gun-making.

Another interesting type of school is the general handicraft school, to which boys of twelve are admitted. The aim is to give the boys a better preparatory training for a trade than is possible in the ordinary elementary school. Great stress is laid on drawing, and the boys are given practical instruction in the preparation of materials for wood and metal work. An experiment on these lines is at present being conducted by the London County Council. There are also higher industrial schools for well-prepared pupils who require a higher training for art, chemical or textile industries, building or engineering. In the larger centres of population there are central industrial institutes, where work of the nature of research is carried on.

The Austrian system of technical education is of special interest at the present time, because there is undoubtedly a tendency in England towards a higher degree of specialisation in the work of technical schools. It is being realised that an efficient system of technical education cannot be organised by the erection all over the country of technical institutes of the same type, with similar classes and laboratories, staffed by the same type of teacher. Some years ago it was discovered that mathematics could be taught for the practical purposes of engineers in a practical way, without much insistence on abstract principles, and since then a good deal of thought has been given to the special educational requirements of the several industries. Moreover, the educative value of the technical processes themselves is being more fully recognised. Mr. W. R. Lethaby, professor of design at the Royal College of Art, in a paper read to the International Drawing Congress on August 3, deprecated the "elaborate approaches to a practical subject" at present in vogue. "The great end," he said, "was production, the great thing was the trade, the craft, and sufficient culture could be hung up to any sufficient trade. . . . All proper education was the opening up of a necessary and beneficent life occupation." This expresses in the clearest way the principle which appears to underlie the Austrian system of technical education. The principle may be stigmatised as utilitarian; but anyone who doubts the practical success of the system will be well advised to examine the exhibits at the Prague Exhibition.

T. LL. H.

THE IMPROVEMENT OF AGRICULTURAL PLANTS.[1]

IN the *Bulletin de la Société d'Encouragement pour l'Industrie nationale* for May, M. Schribaux gives an account of the methods adopted for obtaining new varieties of agricultural plants. These methods fall into three groups:—(1) careful watch is kept for "sports," *i.e.* for plants which, for no obvious reason, differ from the others; (2) variation is induced by altering the conditions of growth; (3) suitable plants are "crossed."

The first method is necessarily haphazard, since sports can obviously not be predicted; it has, however, proved very useful in the past, and has yielded many valuable varieties of potatoes, of fruit trees, &c. The second method promises very interesting results, for some plants respond quickly to changes in their surroundings. M. Schribaux sowed in a garden soil the seeds of the wild carrot, an annual with a woody root. In two generations a certain number had become biennials, with a fleshy root like the cultivated carrot. M. Blaringhem adopted quite a different method with maize. Plants were cut down just as the ear was beginning to develop, *i.e.* at the time of maximum vital activity; 76 per cent. of those surviving developed abnormally. Some were permanently altered; thus a late Pennsylvania maize was converted into an early variety.

Another instance of great practical importance is furnished by the vine. After struggling long and vainly against Phylloxera, the French vine-growers have made up their minds to live with it. M. Viala visited America and brought back some vines which had become so differentiated from those growing in France that they withstood the attacks of the pest. Unfortunately, they would not grow on calcareous soils, but became very chlorotic, and further search was made. Vines were in the end discovered capable of withstanding Phylloxera and of growing on calcareous soils; these have solved the problem for the French grower. Perhaps the case of the sugar-beet is most interesting. The grower requires roots containing a large percentage of sugar, a low proportion of the accompanying salts, and capable of resisting adverse conditions. The selection is made, in the first instance, on the basis of the sugar content. A large number of roots can be rejected by simple inspection, for high sugar content is correlated with certain external features; the other roots are examined chemically, since it is found that removal of a portion for this purpose does not interfere with subsequent growth. The very best are then cut up into a number of pieces to be grafted into other roots; they produce seed, which is sown, and yields roots for further selection. M. Schribaux states that a single root has yielded sixty-four pieces, each capable of producing seed! It is not surprising that the percentage of sugar has gone up from 11 per cent. in 1870 to 16 per cent. or 18 per cent. to-day.

There is evidence, however, that the process will not go on indefinitely, for roots containing more than 18 per cent. of sugar cease to vegetate properly. Sir W. T. Thiselton-Dyer discusses this aspect of the question in the Journal of the Board of Agriculture for April, taking the potato as an illustration. Like the sugar-beet, the potato has been the subject of continual selection, and the end result is a highly artificial tuber of great commercial value but difficult of cultivation. The practical man speaks of degeneration, but Thiselton-Dyer does not consider this to be the case. He points out that the potato has been induced to load itself with starch far in excess of any natural requirement of the plant, and suggests that too much is being demanded of the plant, and the machinery for the processes of growth has reached its breaking point. "We can control nature in altering the constitution of a plant; but eventually a barrier is reached beyond which it is impossible to go."

It is often found difficult to fix the new varieties obtained by selection. Even when asexual reproduction is possible, as in the case of trees and potatoes, the variation frequently does not remain permanent, and many promising varieties have disappeared. When reproduction is by seed

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[1] (1) *Bull. de la Société d'Encouragement pour l'Industrie nationale*, May, 1908.
(2) *Journal of the Board of Agriculture*. April, 1908.
(3) *Journal of Agriculture of South Australia*, January, 1908.

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